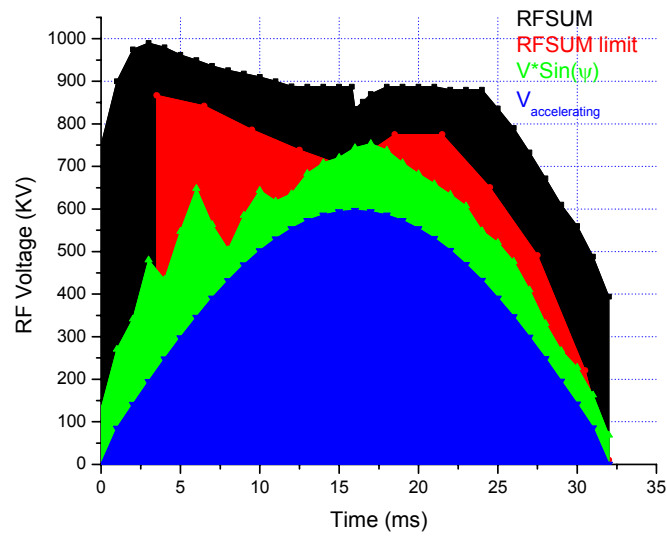


Implications of beam phase and RFSUM measured near transition

Abstract

Understanding the transition-crossing process is crucial for improving Booster performance at high intensity. The synchronous phase appears to drop toward 90° right after transition regardless of beam intensity, more so at higher beam intensity. The implication is that the effective rf voltage (RFSUM) will run into a limit right after transition when the synchronous phase reaches 90° for high intensity beam. A reduction in RFSUM is also observed at the same time. Solutions, such as raising the rf voltage during the transition period or controlling the RFSUM reduction by increasing longitudinal emittance before transition, are potentially important for high intensity operation.



The black curve represents RFSUM over a Booster cycle, the red curve represents the lower limit for RFSUM, the green curve represents the effective accelerating voltage, and the blue curve represents the accelerating voltage required by the magnet ramp, all data were taken under closely similar conditions at the extracted beam intensity of 5.1×10^{12} protons.

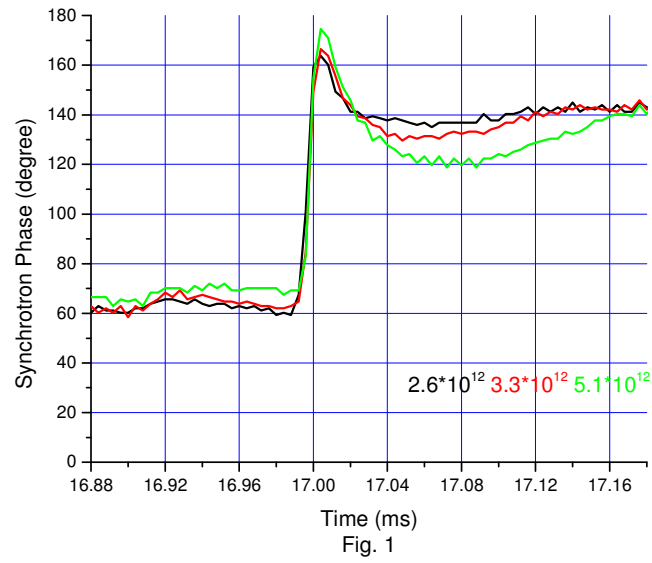
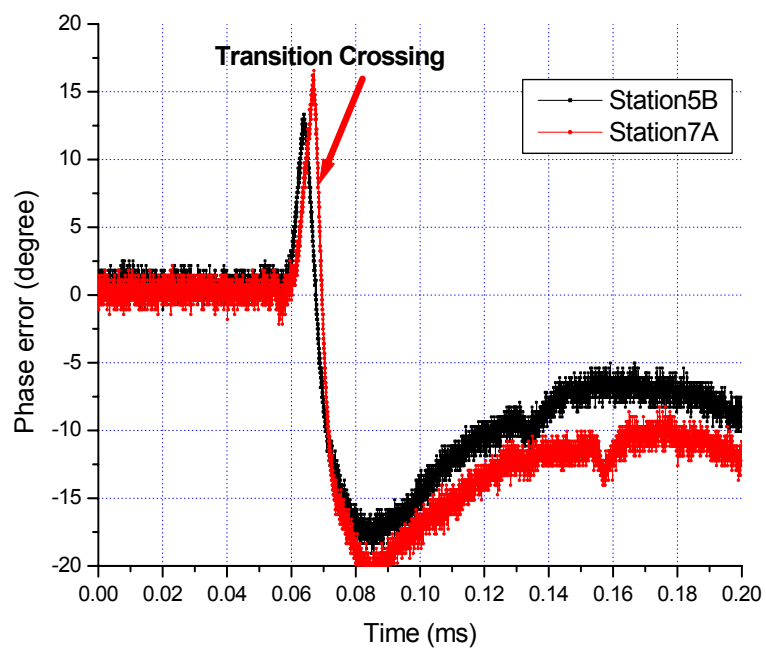


Fig. 1. The synchronous phase measured at three extracted beam intensities of 2.6×10^{12} protons (the black curve), 3.3×10^{12} protons (the red curve), and 5.1×10^{12} protons (the green curve).



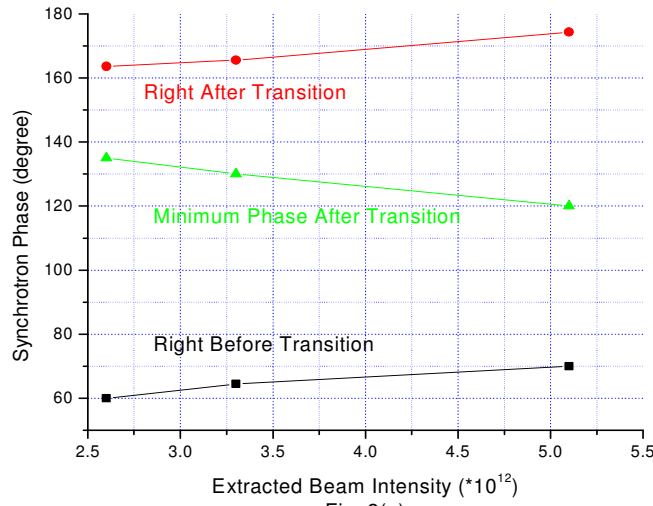


Fig. 2(a)

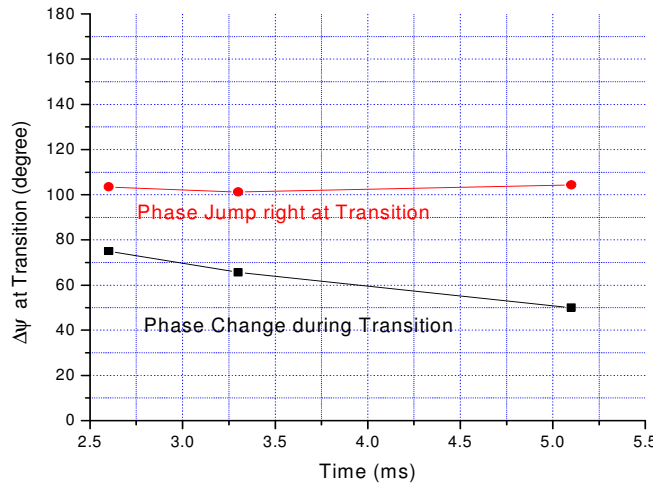


Fig. 2(b)

Fig. 2(a) the black curve represents the synchronous phase right before transition, the red curve represents the synchronous phase right after transition, and the green curve represents the synchronous phase at about 60 μ s -70 μ s after transition when it reached its minimum.

Fig. 2(b) the red curve represents the synchronous phase jump right across transition (the difference between the red curve and black curve in Fig. 2(a)), the black curve represents the synchronous phase change during transition (the difference between the green and black curve in Fig. 2(a)).

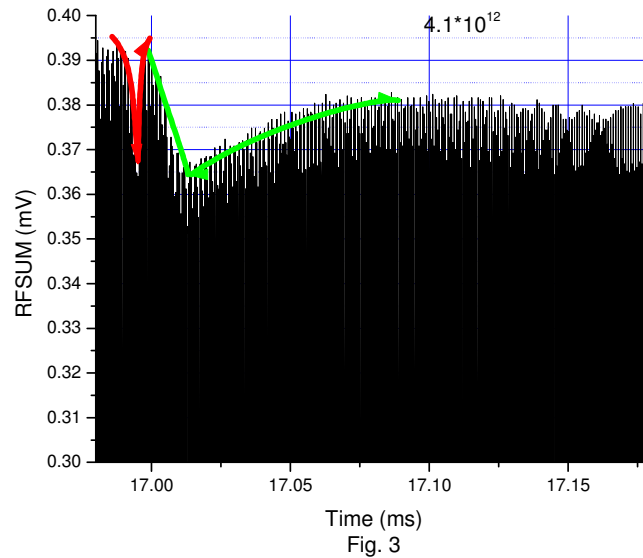


Fig. 3 the RFSUM signal during the transition period. The RFSUM reduction at transition is indicated by red curves. The RFSUM reduction after transition is indicated by the green curves.

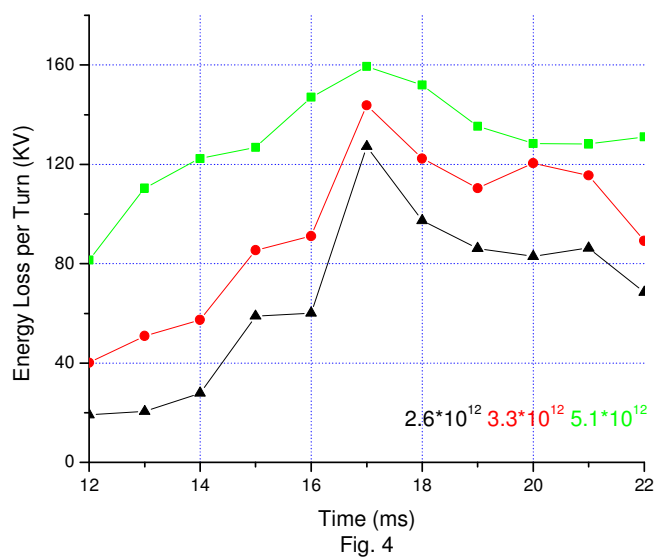
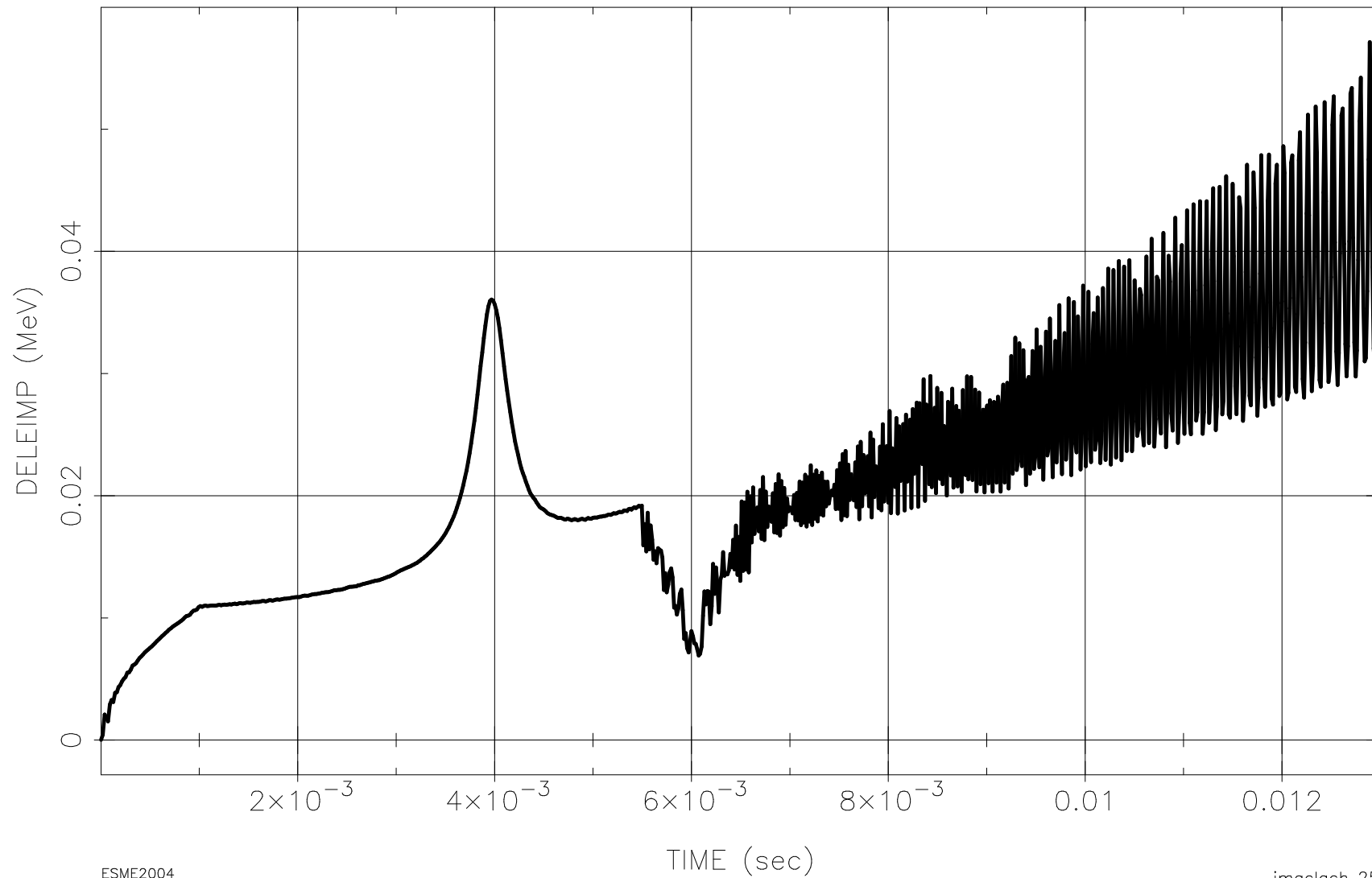


Fig. 4. the estimate of the beam energy loss per turn in a Booster cycle near transition at three extracted beam intensities of 2.6×10^{12} protons (the black curve), 3.3×10^{12} protons (the red curve), and 5.1×10^{12} protons (the green curve).

V_{rf} drop/restore over 5.5 – 6.6 ms, .4 MV min.,
DELEIMP VS TIME



V_{rf} drop/restore over 5.5 – 6.6 ms, .4 MV min.,
PSI(1) VS TIME

